ROHDE&SCHWARZ
Test and Measurement Division

TS8977 System Manual

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1 Introduction

This document contains all system specific information that is necessary to operate and maintain the TS8977 Test System.

The test system supports numerous RF test cases, based on test methods defined in the EN 302-544 Part 2 and EN 302-623: “Harmonized EN for TDD User Equipment covering essential requirements of article 3.2 of the R&TTE Directive”. These test methods can be executed with defined set of parameters, being compliant to the relevant sections of the EN 302-544 respective EN 302 623 test specification. However, the free selection of parameters in order to define customer specific R&D test scenarios is supported as well.

The test system is designed to perform RF tests for WiMAX subscriber (mobile) stations. The system support following WiMAX Profiles:
MP05 (2,5 - 2,69 GHz, 5MHz and 10MHz bandwidth),
MP09 (3,4 – 3,6 GHz, 5MHz bandwidth)
MP10 (3,4 – 3,6 GHz, 7MHz bandwidth)
MP12 (3,4 – 3,6 GHz, 10MHz bandwidth)

To simulate interfering signals, R&S SMU vector signal generators (VSG) are integrated in the TS8977 Test System. The RF output of the DUT is analysed by means of the built-in vector signal analyser (VSA).

The in-band signal switching and conditioning unit SSCU is required to connect the DUT to the RF devices within the test system. It contains all RF components which are not WiMAX specific.A separate Advanced Signal Conditioning Unit (ASCU) is used to filter, combine, split, attenuate or amplify band specific signals which are WiMAX specific.

The system software to operate and maintain the system, namely the RS-PASS Software, is described in the RS-PASS Operation Manual.

2 TS8977 Hardware

2.1 Overview

The TS8977 hardware consists of the following components:

No	Type	Device or Option		Manufacturer
1	PSL3	**System controller**	✔	R&S
		17'' flat screen monitor	✔	
		Mouse	✔	
		Keyboard	✔	
2	FSU26	**Spectrum analyser**	✔	R&S
	FSP-B10	External generator control for ESCI, ESPO	☐	
3	SMU 200A	**RF generator inband (1)**	✔	R&S
	SMU-B106	RF path A 100kHz to 6 GHz	✔	R&S
	SMU-B11	Baseband generator (16 Msample)	✔	R&S
	SMU-B13	Baseband main module	✔	R&S
	SMU-B17	Analog baseband input	✔	R&S
	SMU-B81	Rear panel connectors for 1st RF path	✔	R&S
	SMU-K49	Digital Standard IEEE 802.16	✔	R&S
	SMU-K62	Additional white gaussian noise	✔	R&S
4	SMR27	**RF generator out of band (2)**	✔	R&S
	SMR-B11	Frequency Extension 0.1 – 1 GHz	✔	R&S
	SMR-B15	RF attenuator 20 GHz	✔	R&S
5	NRP-Z21	**Power Sensor 10MHz to 18GHz**	✔	R&S
	NRP-Z4	USB Adapter (passive)	✔	R&S
6	NRP-Z55	**Thermal Power Sensor 0-40GHz**	✔☐	R&S
7	SSCU-77	**Inband Signal Switching and Conditioning Unit**	✔	R&S
8	ASCU-77	**Advanced Signal Switching and Conditioning Unit**	✔	R&S
	---------	Available from August 2008 onwards		--------
9	CMW270	**WiMAX Communication Tester**	✔	R&S
	CMW-B200A	Signalling Unit universal	✔	R&S
	CMW-B270A	WiMAX signalling extension module	✔	R&S
	CMW-B612A	IEEE Interface Module	✔	R&S
	CMW-P752	CMW270 Mainframe 01	✔	R&S
	CMW-KS700	CMW license – signalling (base station emulation)	✔	R&S

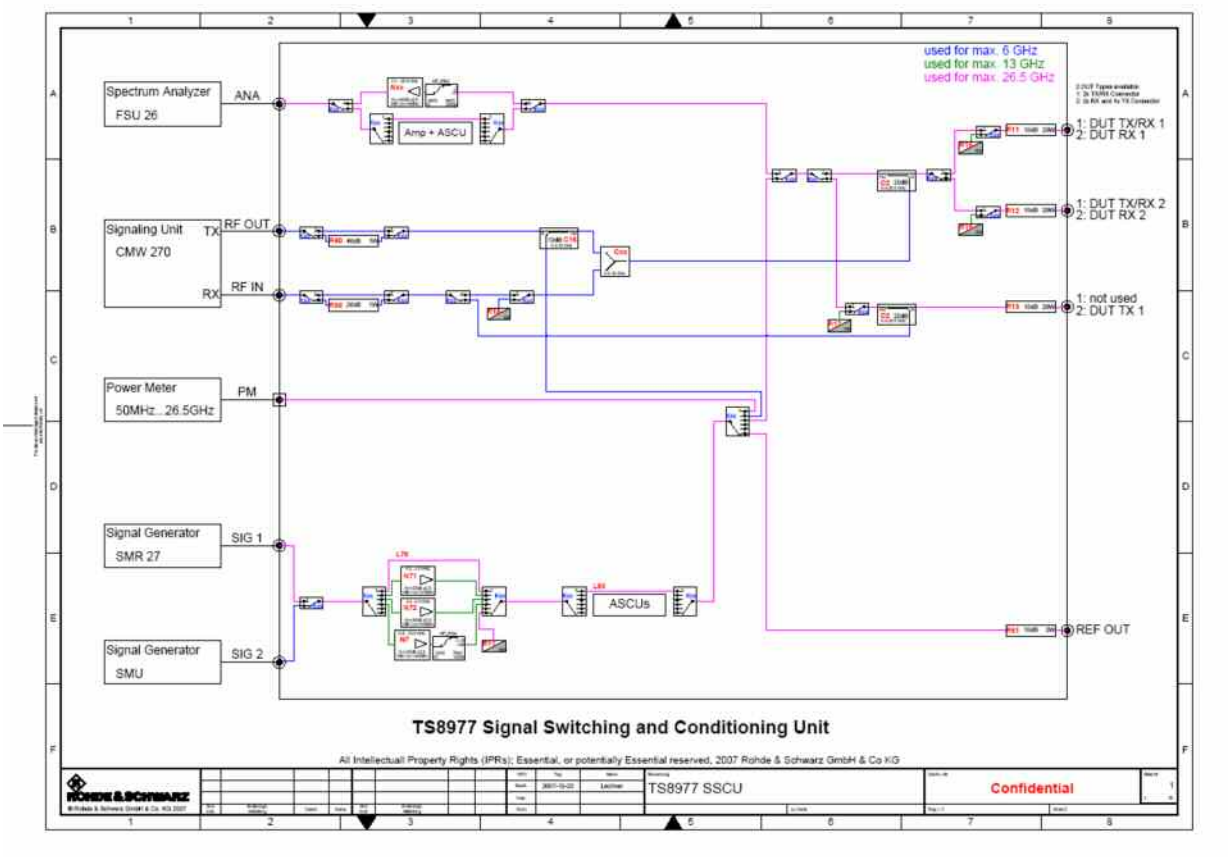

Fig. 2-1 Block diagram of the SSCU

TS 8977 Conformance Test System

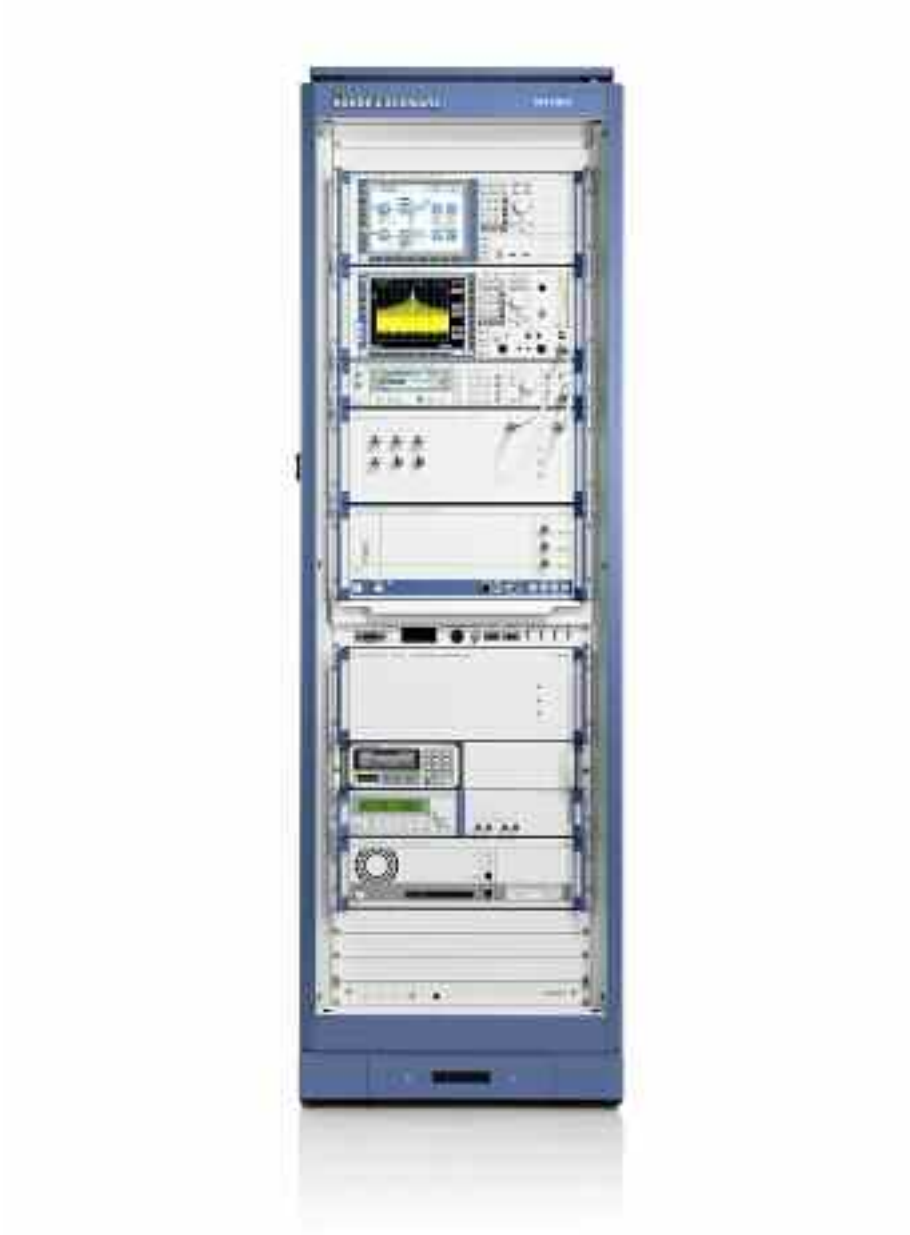

Fig. 2-2 Rack layout of the TS8977 test system

In signalling mode a connection between the protocol and signalling unit and the DUT has to be established.

For transceiver and transmitter tests the signal of the DUT is directed not only to the protocol and signalling unit, but also to the spectrum analyser **FSU**. This transmission path is the so-called **measurement** or **analyser path**.

For receiver tests, interferer signals are generated by the **SMU** and **SMR** signal generators. The interferer signals are combined with the wanted signals of the protocol and signalling unit. This transmission path is the so-called **stimulus** or **generator path**.

2.2 Description of Instruments

2.2.1 System Control Instruments

2.2.1.1 System Controller

The system controller controls all devices within the TS8977. Most of the instruments are commanded via GPIB connection. The exceptions include the switching units SSCU and ASCU, which are connected via parallel interface.

The system controller hosts the RS-PASS software, including the system software with all required device drivers, the applications performing the tests as defined, the graphical user interface and several tools. Please refer to the RS-PASS operation manual for more details.

The system is being delivered with the Rohde & Schwarz PSL3, configured with 512 MB RAM, 2 hard disks and two Ethernet interfaces. The operating system is WINDOWS XP.

Before the system controller can be powered up the monitor, the mouse and the keyboard have to be connected to the TS8977 system panel. To switch “ON” the system, the rocker switch on the front panel has to be pushed behind the flap.

2.2.1.2 Ethernet HUB

The first Ethernet adapter of the system controller is connected to the Ethernet HUB. All TCP/IP devices installed on the system have to be connected to that HUB. However, the second adapter card of the PSL3 shall not be connected to the HUB and cannot be used for a connection to the customer's company network.

Be aware that for connections to the HUB cross link cables can not be used! Only for direct connections between instruments a cross link network cable is necessary.

The SMC Ethernet HUB is not equipped with a power switch. In order to apply power to the device, the power cord needs to be plugged in the AC source. A "power" LED will illuminate when main power is applied. Several activity and state LEDs indicate the status of the connections.

2.2.2 Signal Generating Instruments

2.2.2.1 Signalling Unit CMW270

In most test cases it is necessary to establish a running connection between the test system and the DUT before a RF performance test can be performed.
As a consequence the test system has to simulate a base station. In the case of the simulation of a base station, the test system has to page the DUT, enabling it to access one of the simulated WiMAX cells and simulating the call establishment process. To achieve this, the corresponding protocol

functionalities, defined in the WiMAX specifications, have to be implemented by the use of a signalling device.

In advance of the execution of a test case, a call set-up has to be performed. The system controller instructs the signalling unit to perform the required call set-up via ethernet. After a successful call set-up (initial state), the measurement will be carried out.

In the case of receiver tests, the CMW270 is capable of measuring the PER (Packet Error Rate).

When doing transmitter tests, the CMW270 delivers sophisticated trigger signals. This is especially important for the analysis of signal waveforms performed by the spectrum analyser and triggered by the CMW270.

Wanted Signals

Usually the wanted signal is a standard WiMAX signal.

2.2.2.2 RF Signal Generators SMU and SMR

The RF generator SMU200 is employed to produce interfering signals with frequencies of up to 6 GHz. They are also used to stimulate several RFC and SFT measurements. To generate different kinds of signals, the SMU200s are also equipped with a modulation coder and a data generator.

There is an AC voltage selection feature implemented in the RF signal generator SMU200 that automatically sets itself according to the applied AC voltage. The SMU200 is switched on by first pressing the rear panel AC mains switch followed by the front panel power switch "ON/STBY". Switching off the system at the rear is only necessary, when the instrument is to be disconnected completely from the mains.

Interfering signals

The SMR27 generators can create interfering cw signals up to 27 GHz. The SMR27 is used as generator for the blocking test and the RF path calibration for the spurious emission tests.

2.2.3 Measurement Instruments

2.2.3.1 Spectrum Analyser FSU26

The spectrum analyser FSU26 measures the properties of the DUT´s signal during numerous tests, such as output power as a function of frequency or time, or spurious emissions and spurious response rejection.

Both devices are equipped with an AC voltage selection feature, which automatically sets itself according to the applied power. It has to be checked that the ”ON/STBY” switch, on the front at the bottom left hand corner, is in the correct position. Moreover, an AC mains supply ”ON/OFF” switch is situated on the rear of the device at the top right hand corner. Pressing this rocker switch will apply the AC mains to the instrument.

Measurement Modes of the FSU

Being dependent on the test purpose, the FSQ is operated in different measurement modes:

- **Peak hold**: The maximum value occurring for a certain property during the measurement time is taken.
- **Average**: The measurement value is averaged over the measurement time.
- **Sample**: To analyse the dependence of a certain property against time, each individual measurement value is taken.
- **RMS**: The RMS deviation from the average measurement value is taken.
- **Min/max**: An upper and lower envelope is derived from the individual measurement values.

More than one measurement mode can be applied in a single test run.

2.2.3.2 Power Meter

The power meters NRP-Z21 and NRP-Z55 are used for the RFC and for SFT measurements. It is delivered with an USB adapter NRP-Z4.
The NRP-Z21 and NRP-Z55 are the most accurate devices of the TS8977 system with the typical measurement uncertainty being less than 0.2 dB.
The NRP-Z21 is supplied with power via USB.

2.2.4 Switch Units

2.2.4.1 Main Switching Unit (SSCU-77)

This SSCU-77 is used to interconnect all RF instruments within the system and connects the DUT to the system. This system is indispensable for running test cases. It includes components to split, combine, filter, attenuate or amplify RF signals which are not frequency band specific. The SSCU-77 is designed for a frequency range from 400 MHz to 6 GHz.

The SSCU-77 is powered by DC +5 V, +15 V and +28 V. These voltages are supplied by the switched mode power supply (CS-PSSU), located behind the cover plate at the top of the rack. In order to apply the AC mains to the SSCU, the rocker switch, situated on the right hand of the instrument, has to be depressed. All three yellow LED's, located at the SSCU front panel, should be illuminated.

2.2.4.2 Advanced Signal Switching and conditioning Unit (ASCU-77)

The ASCU-77 is an extension for the SSCU and contains all RF components which are frequency specific for WiMAX frequency bands like filters and amplifiers. The ASCU-77 is designed for a frequency range from 400 MHz to 26 GHz.

2.2.5 Other Instruments

2.2.5.1 AC Power Distributor

The Line distributor (LDE) is used to provide the AC mains voltage to the devices in the test system. It is equipped with an EMI filter that prevents the system from high frequencies on the power line. The LDE has a switch enabling the user switching the system on and off (refer to section 3.2).

The LDE is mounted into the system on the rear side at about the same height as the system controller PSL 3.

2.2.5.2 DC Power Supply

The power supply NGPQ32 is used to provide the DUT with an adjustable amount of energy. It is set into operation with the power switch on the front panel. After being switched on, the digital display shows the last settings of the voltage and current of the outputs. When the system is switched on for the first time, the display will show 0 voltage and 0 current until it has been programmed. The outputs are "off" at this stage.

The NGPQ2 supports four different AC mains supply voltage levels 100 V, 120 V, 220 V and 240 V with system frequencies of 47 Hz to 63 Hz.
The AC mains voltage range must be set to:

- 100 V for e.g. Japan
- 120 V for e.g. USA
- 230 V for e.g. central Europe (exceptions: 220 V e.g. Turkey, 240 V e.g. United Kingdom)

2.3 Interfaces and Connectors

2.3.1 Interfaces

In the table below are the hardware remote interface settings of the system instruments:

Device	Resource Name / Remote Address	Comments
Signalling Unit CMW270	tbd	
Signal generator SMU	GPIB::18	
Signal generator SMR	ASRL1	
Spectrum analyser FSU	GPIB::01	
Power meter NRP	USB::0x0aad::0x000c::_ _ _ _ _ _	
SSCU	LPT::1	
DC Power supply NGMO	GPIB::07	
NRVS	GPIB::20	

The resource settings are checked and updated, when running the System Explorer.

The interfaces and resources are indicated by the parameter **resource** of the physical devices, listed in the system configuration file **…RS PASS COMMON/ini/testsystem.ini**. The name of the system configuration file can be chosen by the user.

2.3.2 Connectors

These are the HF connector settings of the system instruments:

Device	SSCU-77 input	SSCU-77 output	Device input	Device output
Signalling Unit CMW270	SIG RX	SIG TX		
Signal generator SMU	SG2			RF-A
Signal generator SMR	SG1			RF-50 Ohm
Spectrum analyser FSU		SA	RF INP	
Power meter NRP-Z11		PM		Power Probe
SSCU			LPT	
ASCU			LPT	

The connectors are defined in the system and must not be changed.

The settings are indicated by the parameters **SSCU output connector, SSCU input connector, device output connector** and **device input connector** of the physical devices listed in the system configuration file **…RS PASS COMMON/ini/testsystem.ini**.

Not all connectors offered with the system instruments are indicated in the system configuration files, as not all are relevant. The connectors of the SSCU are the following:

Front side SSCU-77

Connector	Remark
SIGNAL ANALYSER RF INPUT	Connection to FSU 'RF_INP'
REFERENCE OUT	RF output used for RFC
MS/BS DUT TX TX1/RX1 TX2/RX2	Connection to mobile station. Mobile Transmitter Combined connector Mobile TX/RX Combined connector MobileTX/RX
SIG TX	Connection to signalling unit CMW270 (receiver part)
SIG RX	Connection to signalling unit CMW270 (transmit part)
SG1	Connection to SMR RF 50 Ohm

Rear side SSCU-77

Connector	Remark
PM	Connection to Power Meter NRP-Z21
PARALLEL PORT IN	Connection to system controller ‘LPT 1’ for ISSCU control
PARALLEL PORT OUT	Not connected
SG2	Connection to SMU RF-A
ANALYSER BOX Input Output	 Connection from ASCU-77 Coonection to ASCU-77
GENERATOR BOX Input Output	 Not connected Not connected

Front side ASCU-77

Connector	Remark
none	

Rear side ASCU-77

Connector	Remark
ANALYSER BOX Input output	 Connection from SSCU-77 Connection to SSCU-77
GENRATOR BOX Input	 Not connected

Connector	Remark
Output	Not connected

The connectors of the signal generating and measurement devices are described thoroughly in the corresponding manuals.

2.4 Operating Conditions

The optimum environmental conditions for the TS8970 system are the following.

Temperatures below the specified values are not critical.

Temperatures above the specified values should be avoided in order to prevent damages!

- **Operating temperature for the TS8977** : 23°C ± 3°C
- **Temperature range after RF calibration** : ± 2°C
- **Temperature of the rack mounted components** : 20°C to 40°C
- **Temperature of the SSCU-77** : 20°C to 40°C
- **Temperature of the ASCU-77** : 20°C to 40°C
- **Temperature of the components inside SSCU** : 20°C to 45°C
- **Temperature of the components inside ASCU** : 20°C to 45°C
- **Humidity** : 20 to 80 %

2.5 Calibration Requirements

The system device calibration is recommended to be done within an interval of 1 year. It is independent from the instrument´s internal calibration or the RFC, described in the RS-PASS Operation Manual.

3 Starting Operation

3.1 Preparing for Use

3.1.1 Cabling

It is recommended to check the cabling of the system. Every original cable, used for the cabling of the system, is labelled with the name of the device to be connected to it.

It has to be taken care, that all cables are connected correctly!

The **DUT cable** has to be connected to the **DUT Tx/Rx connector**. It has to be made sure that the specific DUT cable is indicated as active in the system configuration *.ini file. The DUT cable configuration is done in the system editor of the TSCC and is described in detail in the RS-PASS Operation Manual.

Before running a WiMAX or another RFC application, the RFC calibration of the DUT cable has to be accomplished.

(The calibration of the DUT cable is described in the RS-PASS Operation Manual.

A rough overview over the system´s internal connections is given in section 2.3.2.

3.1.2 Devices

The device´s internal calibration can be updated by running the self test calibrate_all. The internal calibration is independent to the RFC and is described in detail in the RS-PASS Operation Manual.

3.1.3 System Configuration

After the start of the system the configuration, especially the device resource (bus systems used to control the devices and device addresses) and connector settings, has to be checked. **This is done by running the System Explorer,** thoroughly described in the RS-PASS Operation Manual.

When the system is started for the first time, i.e. after installation of the RS-PASS software, the System Explorer has to be executed before other applications can be carried out.

The device interfaces and connectors are described in section 2.3.

3.2 System Switch On/Off and Start/Shutdown

3.2.1 Instrument Switch On/Off

SYSTEM POWER ON/OFF

In order to start the system, the instruments have to be switched **ON**. Main power is applied by pushing the switch at the rear bottom of the system. With this switch all instruments can be switched ON and OFF .

Additionally, most instruments can be switched ON/OFF, or put into standby mode individually by pressing the relevant power button at the front panel:

STBY / ON to set the device into standby mode
OFF / ON to switch the device off/on

Most of the devices have a main power switch at the rear panel to connect or disconnect it from the mains. For more details please refer to the instrument descriptions in section 2.2 .

If the main power connection at the rear of an instrument is switched off, then this device cannot be switched on with the SYSTEM POWER ON/OFF switch or with the ON/STBY and ON/OFF button at the front panel of the instrument.

3.2.2 System Start and Shut Down

After switching on the test system, the system controller automatically starts booting. After booting is finished, a login window is displayed and the username and password has to be entered. The default logins are:

- **System Manager**: User name: ‘administrator’
  Password : delivered without password
- **Account TS8977**: User name: ‘ts8977’
  Password : ‘ts8977’

Both accounts hold system manager rights, required e.g. for a system software update. To ensure, that users cannot damage the operating system, please make sure to create individual user accounts for daily work!

3.2.3 Start and Shut Down of the Signalling Unit

When the main switch "SYSTEM POWER ON/OFF" at the rear system panel is used to start the TS8977 test system, the signalling unit is automatically started as well. When switching off the system it also powers down the signalling unit.

The CMW270 has to be shut down regularly - like the WINDOWS main system - to avoid damages to the software!

4 WiMAX Applications

4.1 Test Case List

This section lists the conformance test cases delivered by R&S and gives an overview which test methods are provided. All descriptions and tables in this document are composed according to the EN 302-504 part 2 and EN 302 623 test specifications. In both specification similar test cases are described, but unfortunately the test case numbering is different. For example, the spectrum emission mask test has in EN 302-544-2 the test case number 4.2.2 whereas in the EN 302 623 the number is 4.2.3. In order to use the same test method for the similar test cases in the RS PASS SW there is following mapping to achieve same number for same test cases:

RS PASS TC Number	Test Case	TC Number in EN 302 544-2	TC Number in EN 302 623
TX Tests			
1.1	Spectrum Emission Mask	4.2.2	4.2.3
1.2	TX Adjacent Channel Leakage Power Ration	4.2.3	4.2.4
1.3	TX Spurious Emissions	4.2.4	4.2.5
1.4	Accuracy of max. Output Power	4.2.5	4.2.2
1.5	TX Power Control	4.2.6	4.2.6
1.6	Control & Monitoring Functions	4.2.7	4.2.9
RX Tests			
2.1	RX Intermodulation Rejection	4.2.11	n.a.
2.2	RX Adjacent and Alternate Channel Rejection	4.2.9	4.2.8
2.3	RX Spurious Emissions	4.2.8	4.2.7
2.4	RX Blocking	4.2.10	n.a
2.5	RX Spurious Response	4.2.12	n.a.

For details and up-to-date information on test cases, please refer to the latest version of the mentioned specifications and release notes of the RS-PASS Software.

As the test system devices are hardlock protected, the availability of the test cases may depend on individual registered options.

4.1.1 Receiver Tests

The following test cases are currently available:

4.1.1.1 EN 302-544 part 2

Section of EN 302-504 part 2 Specification	Test Cases	Testmethod
4.2.8	Receiver Spurious Emissions	WiMaxHarmonizedMsTrx.exe
4.2.9	Receiver Adjacent Channel Selectivity	WiMaxHarmonizedMsReceiver.exe

4.1.1.1.1 EN 302-544 part 2

Section of EN 302-544 part 2 Specification	Parameter files	Remark
4.2.8	MS_2.03_norm_3A5_Rx_SpuriousEmissions.par	
	MS_2.03_norm_3A10_Rx_SpuriousEmissions.par	
4.2.9	MS_2.02_norm_3A5_AdjacentChannelRejection.par	
	MS_2.02_norm_3A10_AdjacentChannelRejection.par	

4.1.1.2 EN 302- 623

Section of EN 302-623 Specification	Test Cases	Testmethod
4.2.7	Receiver Spurious Emissions	WiMaxHarmonizedMsTrx.exe
4.2.8	Receiver Adjacent and Alternate Channel Rejection	WiMaxHarmonizedMsReceiver.exe

4.1.1.2.1 EN 302-623

Section of EN 302-623 Specification	Parameter files	Remark
4.2.7	MS_2.03_norm_5AL_Rx_SpuriousEmissions.par	
	MS_2.03_norm_5BL_Rx_SpuriousEmissions.par	
	MS_2.03_norm_5CL_Rx_SpuriousEmissions.par	
4.2.8	MS_2.02_norm_5AL_AdjacentChannelRejection.par	
	MS_2.02_norm_5BL_AdjacentChannelRejection.par	
	MS_2.02_norm_5CL_AdjacentChannelRejection.par	

4.1.2 Transmitter Tests

The following test cases are currently available:

4.1.2.1 EN 302 544 part 2

Section of EN 302-544 part 2 Specification	Parameter files	Testmethod
4.2.2	Spectrum Emission Mask	WiMaxHarmonizedMsTrx.exe
4.2.3	TX Adjacent Channel Leakage Power Ratio	WiMaxHarmonizedMsModulationQuality.ex
4.2.4	Transmit Spurious Emissions	WiMaxHarmonizedMsTrx.exe
4.2.5	Accuracy of max. Output Power	WiMaxHarmonizedMsStaticPower.exe
4.2.6	Transmitter Power Control	WiMaxHarmonizedMsStaticPower.exe
4.2.7	Control and Monitoring Functions	WiMaxHarmonizedMsStaticPower.exe

4.1.2.1.1

	Parameter files	Remark
4.2.2	MS_1.01_norm_3A5_SpectrumEmissionMask.par	
	MS_1.01_norm_3A10_SpectrumEmissionMask.par	
4.2.3	MS_1.02_norm_3A5_ACLR.par	
	MS_1.02_norm_3A10_ACLR.par	
4.2.4	MS_1.03_norm_3A5_Tx_SpuriousEmissions.par	
	MS_1.03_norm_3A10_Tx_SpuriousEmissions.par	
4.2.5	MS_1.04_norm_3A5_MaxOutputPower.par	
	MS_1.04_norm_3A10_MaxOutputPower.par	
4.2.6	MS_1.05_norm_3A5_TransmitterPowerControl.par	
	MS_1.05_norm_3A10_TransmitterPowerControl.par	
4.2.7	MS_1.06_norm_3A5_ControlAndMonitoringFunctions.par	
	MS_1.06_norm_3A10_ControlAndMonitoringFunctions.par	

4.1.2.2 EN 302-623

Section of EN 302-544 part 2 Specification	Parameter files	Remark
4.2.2	Accuracy of max. Output Power	WiMaxHarmonizedMsStaticPower.exe
4.2.3	Spectrum Emission Mask	WiMaxHarmonizedMsTrx.exe

4.2.4	TX Adjacent Channel Leakage Power Ratio	WiMaxHarmonizedMsModulationQuality.ex
4.2.5	Transmit Spurious Emissions	WiMaxHarmonizedMsTrx.exe
4.2.6	Transmitter Power Control	WiMaxHarmonizedMsStaticPower.exe
4.2.9	Control and Monitoring Functions	WiMaxHarmonizedMsStaticPower.exe

4.1.2.2.1

	Parameter files	**Remark**
4.2.2	MS_1.04_norm_5AL_MaxOutputPower.par	
	MS_1.04_norm_5BL_MaxOutputPower.par	
	MS_1.04_norm_5CL_MaxOutputPower.par	
4.2.3	MS_1.01_norm_5AL_SpectrumEmissionMask.par	
	MS_1.01_norm_5BL_SpectrumEmissionMask.par	
	MS_1.01_norm_5CL_SpectrumEmissionMask.par	
4.2.4	MS_1.02_norm_5AL_ACLR.par	
	MS_1.02_norm_5BL_ACLR.par	
	MS_1.02_norm_5CL_ACLR.par	
4.2.5	MS_1.03_norm_5AL_Tx_SpuriousEmissions.par	
	MS_1.03_norm_5BL_Tx_SpuriousEmissions.par	
	MS_1.03_norm_5CL_Tx_SpuriousEmissions.par	
4.2.6	MS_1.05_norm_5AL_TransmitterPowerControl.par	
	MS_1.05_norm_5BL_TransmitterPowerControl.par	
	MS_1.05_norm_5CL_TransmitterPowerControl.par	
4.2.7	MS_1.06_norm_5AL_ControlAndMonitoringFunctions.par	
	MS_1.06_norm_5BL_ControlAndMonitoringFunctions.par	
	MS_1.06_norm_5CL_ControlAndMonitoringFunctions.par	

4.2 Transmit/Receiver Tests (TRX)

4.2.1 Test Description

Transmitter Tests (TC numbers according to EN 302-544 part 2)

4.2.2 Spectrum Emission Mask

Spectrum emission mask defines an out of band emission requirement for the transmitter. These out of band emissions are unwanted emissions outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions.

The spectrum emission mask of the UE applies to frequency offsets between 2,5 MHz and 12,5 MHz on both sides of the UE centre carrier frequency.
The out-of-channel emission is specified as power level measured over the specified measurement bandwidth but relative to Pnom of the UE carrier measured in Eval_BW1 centred in the 5MHz channel.

The spectrum emission mask of the UE applies to frequency offsets between 5 MHz and 25 MHz on both sides of the UE centre carrier frequency.
The out-of-channel emission is specified as a power level relative to Pnom of the UE carrier measured in Eval_BW1 centred in the 10 MHz channel.

4.2.3 Transmitter Adjacent Channel Power Ratio (ACLR)

Adjacent channel leakage power ratio (ACLR) is the ration measured through a filter pass band centred on the assigned channel frequency to the mean power measured through a filter pass band centred on a first or second adjacent channel.

4.2.4 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions. This is measured at the RF output port.

4.2.5 Nominal maximum output power and tolerance

The nominal maximum output power (Pnom) is the nominal mean power level measured over total allocated channel bandwidth available at the antenna connector. The tolerance of the output power is the difference between the declared Pnom and the actual maximum output power with the corresponding tolerance limits.

4.2.6 Transmitter power control

Transmit Power Control (TPC) is a mechanism that shall be used by the equipment to ensure a mitigation factor on the aggregate power from a large number of devices to improve the spectrum sharing conditions.

4.2.7 Control and Monitoring Functions

This requirement verifies that the control and monitoring functions of the UE prevent it from transmitting in the absence of a real network.

Receiver Tests (TC numbers according to EN 302-544 part 2)

The receiver test method covers various test cases for the subscriber station. Most of these test cases are based on the criterion that a connection between the DUT and the emulator is accomplished with a PER (packet error rate) below a certain limit.

4.2.8 Receiver Spurious Emissions

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The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector

4.2.9 Receiver adjacent channel selectivity (ACS)

The receiver and alternate channel selectivity (ACS) is a measure of the receivers ability to receive a wanted signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the center frequency of the assigned channel. ACS is the interferer power level (in dB) relative to the thermal noise.

5 Glossary

AC	Alternating Current
BER	Bit Error Ratio
BPSK	Binary PSK
BS	Base Station
BSSE	Base Station and Subscriber Emulator
BW	Band Width
CINR	Carrier-to-Interference-and-Noise Ratio
DC	Direct Current
DL	Down Link
DUT	Device Under Test
FDD	Frequency Division Duplex
FCH	Frame Control Header
GPIB	General Purpose Interface Bus
HF	High Frequency FDD
H-FDD	Half Duplex
IEEE	Institute of Electrical and Electronic Engineers
IF	Intermediate Frequency
IP	Internet Protocol
IQ	Inphase Quadrature
ISSCU	Inband Signal Switching and Conditioning Unit
ITU	International Telecommunication Union
LAN	Local Area Network
LED	Light Emitting Diode
LPT	Local Parallel Port
MCS	Modulation and Coding Scheme
MS	Mobile Station
MRC	Maximum Ratio Combining
MRCT	Mobile Radio Conformance Test
OFDM	Orthogonal Frequency Division Multiplex
PASS	Parametrical Application Software for Systems
PER	Packet Error Rate
PSD	Power Spectral Density
PSK	Phase Shift Keying
QPSK	Quadrature PSK
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RFC	Radio Frequency Calibration
R&S	Rohde & Schwarz
RSSI	Receive Signal Strength Indicator
RX	receive
SBS	Serving Base Station
SFT	Self Test
SIG	Signal
SS	Subscriber Station
SSRTG	SS receive to transmit turnaround time
SSTTG	SS transmit to receive turnaround time
SW	Software
TCP	Transmission Control Protocol
TDD	Time Division Duplex

TSCC	Test System Control Center
TX	transmit
UL	Up Link
USB	Universal Serial Bus
VSA	Vector Signal Analyser
VSG	Vector Signal Generator
WiMAX	Worldwide Interoperability for Microwave Access